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ginning and during the continuance of the current from G being established, and as the whole action is comprehended in these two periods of time, this apparently inexplicable fact would seem to be explained.

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THE PRESENT PROBLEMS OF ORGANIC EVOLUTION.\*

AT the outset of a conference on the subject of evolution, it is necessary that we understand what we mean by the term. Evolution is creation by energy which is intrinsic in matter, and is not creation by energy exclusively without the evolving matter. Those who explain creation by interference from an external creative power are not therefore evolutionists. This view of creation is opposed to the natural tendency to account for phenomena not otherwise explainable, by an appeal to a supernatural cause. If we desire to know the truth, however, in this or any other matter, it is necessary to divest ourselves of prepossessions and preferences, and rely exclusively on the evidence. But the result of this method in the case of organic evolution is to demonstrate, in my opinion, that the elements of mind have had an important place in the process and have materially influenced the results.

The evidence for organic evolution, it is well known, is derived from three sources: First, the spontaneous variations from uniformity of structure, frequently observed in plants and animals; second, the regular succession of forms displayed in the history of life, taught by the science of paleontology; third, the recapitulation of the same succession, more or less completely, in the embryonic histories of organic beings. As time passes on, the evidence of the origin of species and the groups into which they fall by

modification during descent from preëxistent forms becomes more and more perfect.

The problems presented by the preceding facts for solution may be embraced under two heads: (1) how are the variations or changes in individuals produced? and (2) when produced, are they inherited and so accumulated, or not?

The question as to the cause of variation is difficult of solution. The attempt to solve it must be preceded by a knowledge of what the lines of variation which constitute evolution have been. These are presented by the study of the life of past geologic ages. From this source we learn that there has been a successive improvement in the mechanisms of organic beings. Since the mechanisms are constructed of always plastic, and for a time growing, material, it looks probable that they have been produced by the movements of the organism itself. This suspicion is made a certainty when we learn that new mechanisms are readily constructed by organic beings, to take the place of their normal ones which have been injured or lost. The annals of surgery and of orthopedic hospitals are full of such cases, and the lower animals are still more capable of producing new structures to take the place of old ones than is man. I do not mean by this the reproduction of lost parts, as in the case of the crab and its pincer; but I mean the construction of a new joint or segment in a new place, which is obviously moulded by the mechanical action of the parts.

The movements of animals have led their progressive evolution, and a great many structures have been modified in consequence in ways which are indirect, and whose characters do not always betray their real efficient cause without full investigation. *Per contra*, the absence of motion has resulted in degeneracy and retrogressive evolution. This is amply demonstrated by the results of parasitism. Parasites are always degenerate. This is the

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\* Abstract of a lecture by Professor E. D. Cope given at the opening of the *Conference of Evolutionists* at Greenacre-on-the-Piscataqua on July 6th and reported in the *Boston Transcript*.

doctrine of use and disuse of Lamarck, precisely defined and demonstrated.

The cause of the movements of organic beings are various. The best known are conscious states, as hunger, cold, heat, and various other sensations; some of them of higher mental grade, as fear, anger, etc. Movements by the lowest animals, as that drop of jelly, the *amœba*, appear to be the result of sensations, but owing to the simplicity of the structure, it is easy to doubt that this can be the case. It is, however, impossible at present to assign any other cause to some of the movements even of the *amœba*, although it must be admitted that our knowledge is slight. The phenomenon of heliotropism, for instance, when these simple creatures leave the dark and crowd into light places, cannot be shown to be due to chemical or physical causes only. They seek oxygen, which is more abundant where sunlight penetrates, but they have to be aware that they need it, and must have some knowledge of the fact when when they get it. This indicates a low grade of consciousness. But it is consciousness, nevertheless. But whatever may be the state of the case with the *amœba*, we do not have to ascend far above it in the zoölogical scale before we meet with clear evidences of the presence of sensation. Hunger, for instance, is a form of consciousness, although it is due to a physical condition.

The result of progressive evolution in animals is developed mechanism of motion, which enables an animal to change or make its environment; and improved intelligence, which serves as a guide in all the contingencies of life. The result of retrograde evolution is the reverse of this. It is probable that no progressive evolution could have taken place without the presence of sensation. As an illustration of retrogressive evolution on a grand scale, we have the vegetable kingdom. Originally freely

moving *amœbas*, the ancestors of plants became sessile or earth parasites. The result is that they have become bound to their environment, which they cannot change. They have therefore to suffer enormous destruction. To counteract this they have developed equally enormous powers of reproduction. In fact, although the vegetable kingdom is essential to the existence of the animal kingdom, for itself it has accomplished progress in but one direction, that of reproduction.

The contrast presented by the animal kingdom is great, and as the result has been man it is evident that the process has been as a whole progressive. The element of sensation at the bottom of it has been probably the central directive point, like the live bud on the apex of a tree. Though of limited local distribution, it has led the way, and all other modifications have followed.

The other problem for solution to which I have referred is that of inheritance. The inheritance not only of the characters of species, but of individual and family traits, is commonly accepted as a fact. But many things are not inherited, such as injuries to the organism, except in very exceptional cases, so that it has been questioned whether any character acquired by the organism during its life can be inherited. But so far as regards certain characters already referred to as having been acquired by movements of the parts, it is clearly proved that they are inherited, as they are found in the embryo before birth, and were therefore inherited by the offspring directly from the parents and were not produced by themselves. It is evident that the characters of the vertebrate skeleton were acquired through motion, or use, by gradual accretions of modifications, and that these modifications were inherited by the successive generations. Each generation added its quota to the result, which thus steadily pro-

gressed to completion. This was reached when the structures fully met the stresses and impacts, which became therefore too feeble to be further effective.

We have here then demonstrated the effect of known agencies in the production of variations. These are not the only ones which are active. The effects of light, temperature and humidity have been studied and the results noted, and it is evident that such effects have been also inherited. Evolution under the influence of such causes I have called physiogenesis, while that which results from the mechanical effects of motions I have termed kinetogenesis. The results of these processes have been submitted to the tribunal of natural selection, and the best have survived. As the direct mechanical effects of use are, however, the best obtainable under the circumstances, it is evident the natural selection in a good many cases has to do only with the struggle between the widely different types of life which are associated together in a given fauna or flora, and not so much between the individuals of each species.

The energy of progressive organic evolution is thus excluded from the domain of chance, by the transmission of all kinds of stimuli through a medium of consciousness, which has its distinctive effect on the response.

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#### PHILOSOPHY IN THE GERMAN UNIVERSITIES.

A BRIEF summary of the lectures announced for the summer semester at the German universities may serve to show the the present status of philosophy in these institutions. The lectures here enumerated include only those offered by the philosophical faculties. No attempt is made to mention all the names familiar to American readers, but merely the most important.

The summary is as follows:

Berlin. Professor Paulsen—History of

Modern Philosophy with reference to the general development of modern civilization; Psychology as the basis for all the special philosophical sciences; Ueber das Akademische Studium; seminar, Kant's *Critic of Pure Reason*. Professor Stumpf—Logic and Theory of Knowledge; seminar, Theoretical and Experimental Psychology. Professor Dilthey—History of Philosophy; seminar, History of Modern Philosophy. Other courses: History of Philosophy; History of 19th Century Philosophy; History of Ethics; History of Æsthetics; Neoplatonism; Elementary Questions in Philosophy; Psychology with demonstrations; Social Psychology; Philosophy of Religion; Practical Morals; Æsthetics; Pedagogy.

Leipzig. Prof. Wundt—Psychology; Psychological Laboratory. Prof. Volkelt—Kant's Philosophy; History of Pedagogy from the Renaissance; in seminar, Aesthetics of the Lyric. Other courses: Introduction to Philosophy and Logic; Chief Problems of Philosophy; Selected Questions in Metaphysics; Psychology of Hearing; Pedagogy; Seminar on Ethical Questions and Theory of Knowledge based on Locke's Essay; *Lecture*, Kant's *Prolegomena*.

Halle. Prof. Erdmann—Psychology; Elements of Physiological Psychology; History of Pedagogy from the beginning of the 18th century; seminar, Kant's *Critic of Pure Reason*. Prof. Vaihinger—Introduction to Philosophy; Logic; in seminar, Pedagogical Psychology, with special notice of Herbart's pedagogical writings. Other courses: History of Philosophy; Philosophy since Hegel; Logic; Limits of Human Knowledge; Recent Investigations in Deductive Logic; Ethics; Pedagogy; Seminar on Aristotle's '*De anima*' and Mill's *Logic*.

Jena. Prof. Liebmann—Metaphysics; History of Ancient Philosophy. Prof. Eucken—History of Philosophy since Kant; Philosophy of Religion; Introduction to Philosophy; Philosophical Terminology.